بسم الله الرحمن الرحيم

Every morning is a blank canvas...
It is whatever you make out of it
Good Morning

Pulp and Periapical diseases

Dr: Ebtesam Osama Abo El-Mal

Lecturer of Endodontics

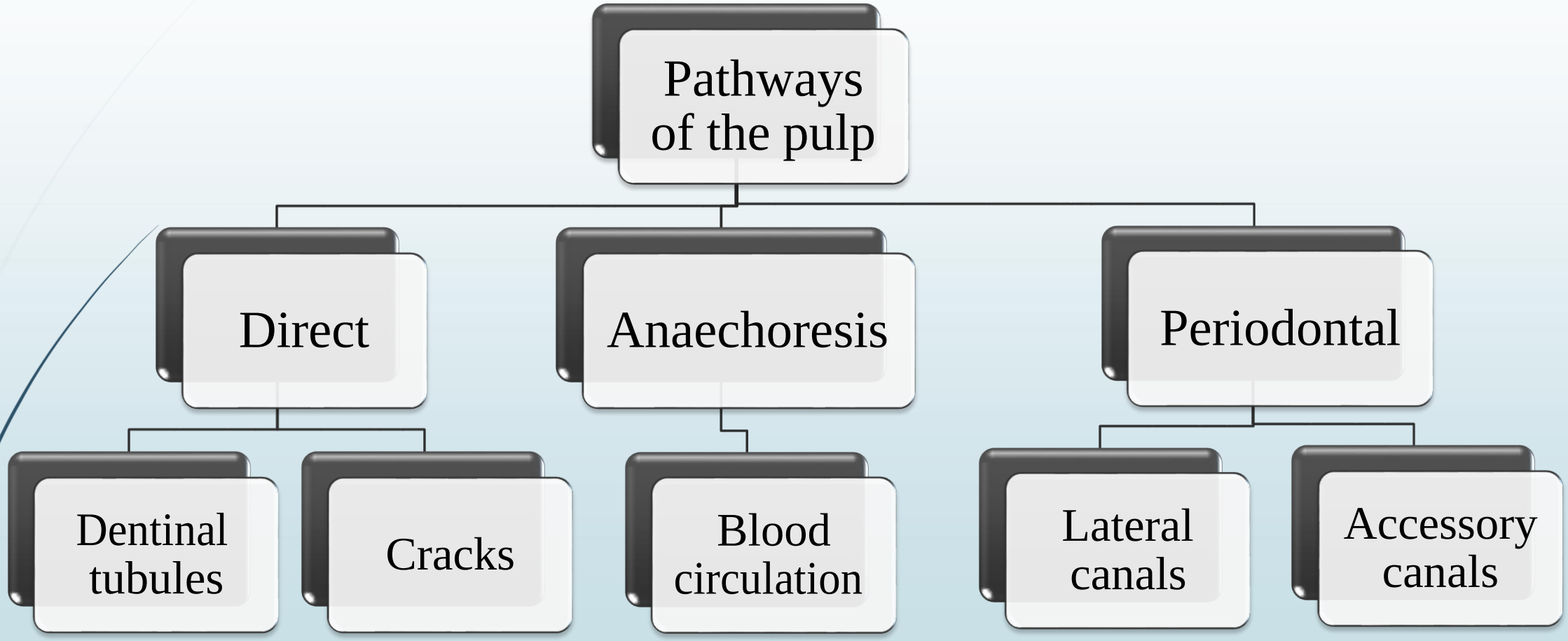
What is the difference between pulp tissues and other connective tissues?

- Pulp connective tissue is surrounded by hard dentinal wall → unable to expand.
- Lacks collateral circulation → limited healing capacity.
- Response to irritation → formation of reparative Dentin.

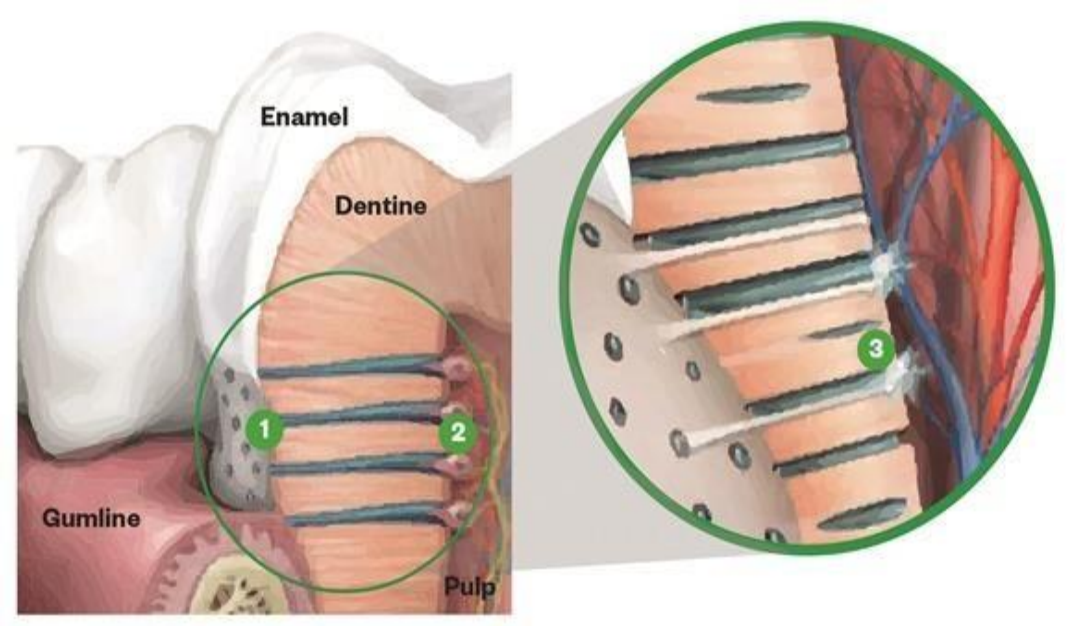
Etiology of pulpal inflammation:

- Microbial: Bacteria and bacterial by-products.
- Iatrogenic: either physical, thermal or chemical.
- Traumatic: blow to the face or occlusal trauma.
- Idiopathic: unknown cause.

How can bacteria reach the pulp?

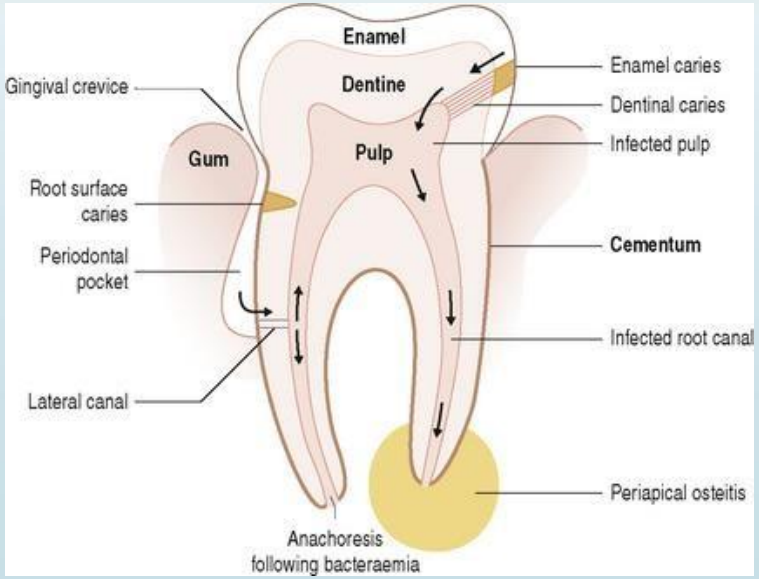


Direct pathway



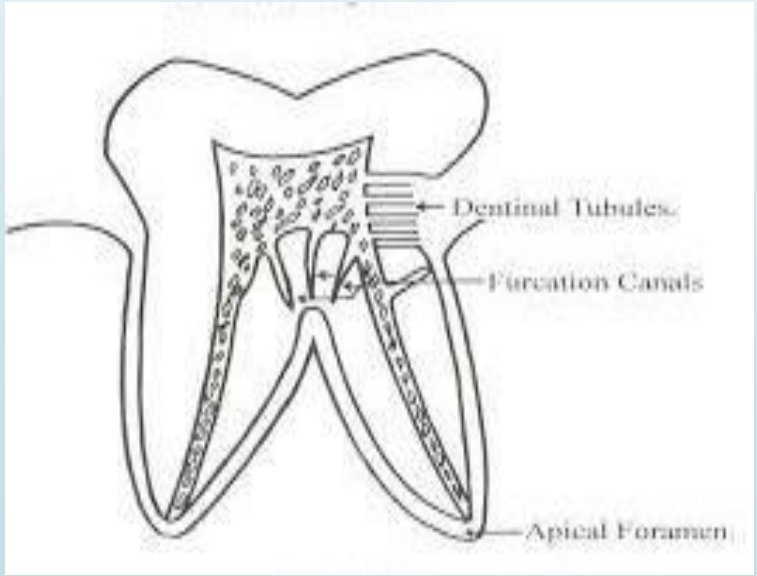
Anaechoresis

- Infection from a remote area carried through the blood circulation (blood borne).



Periodontal

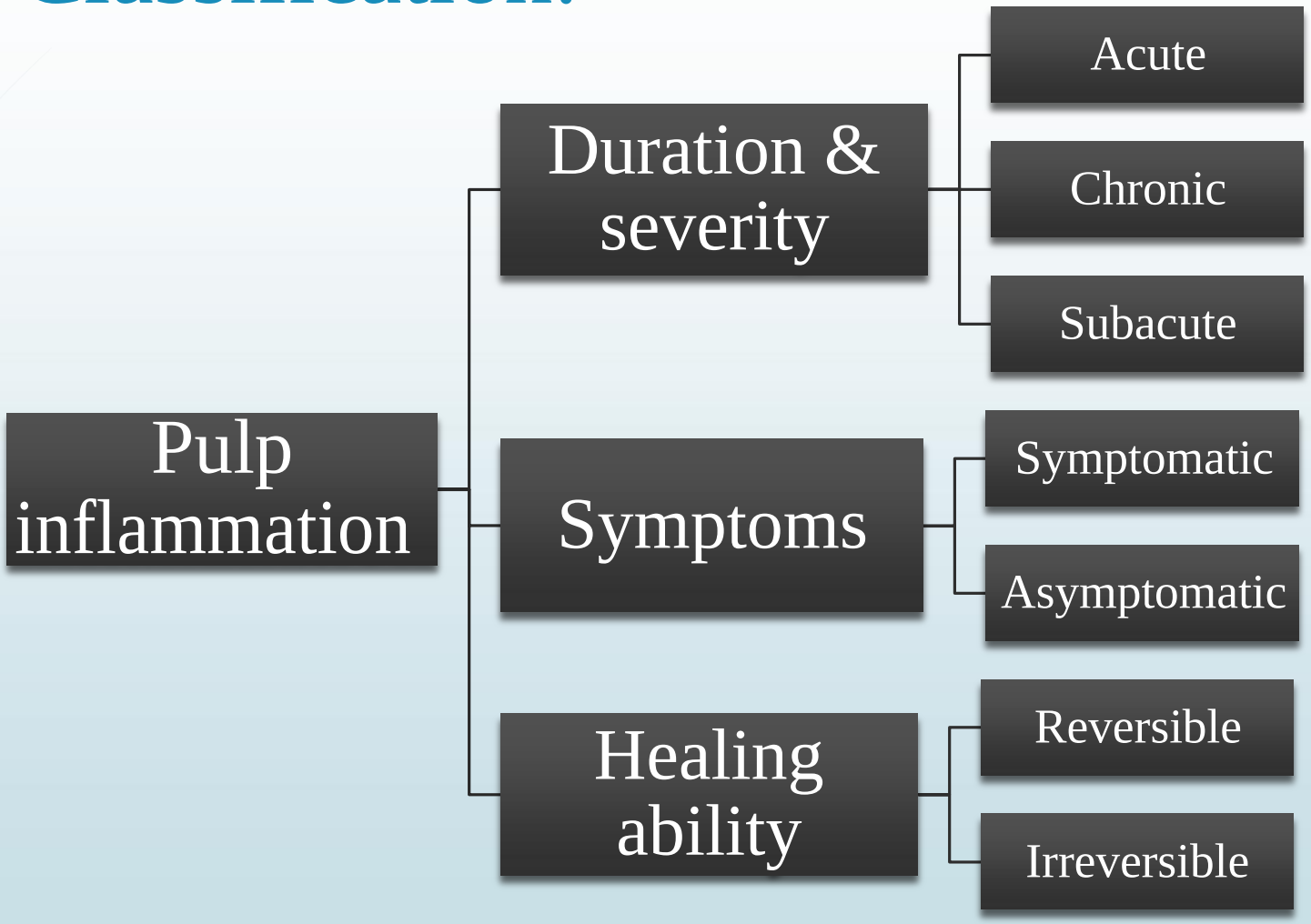
- Infection reaches the pulp tissues through lateral and accessory canals found in the gingival crevice, periapical or furcation areas.



Inflammatory Process:

- Irritation → inflammation → vasodilatation→ pressure rise inside blood vessels → collapse of venous return→ blood stagnation → interrupt blood transport in the microcirculation → release of exudates→ rise of interstitial pressure→ tissue hypoxia and anoxia → necrosis → tissue breakdown products → release of osmotic pressure → pulling out more exudates → attracting PMNS → pus → microabscess formation.
- Life span of PMNS → from 4 hours to 13 days.

Classification:



Diseases of the pulp

I] Inflammatory pulpal diseases:

- *A) Hyperemia (Reversible pulpitis or Dentin hypersensitivity):*

❖ Local vasodilatation ⟶ elevated capillary pressure ⟶ increase vascular permeability ⟶ oedema.

❖ *Characteristics of pain:*

- i) caused by mild irritants (heat, cold, sweet & sour).
- ii) non spontaneous.
- iii) stops immediately as the irritant is removed.
- iv) described as shock sensation or sharp with short duration.

❖ *Clinical picture:*

- i) presence of carious cavity, recent filling without base, recent crown preparation.
- ii) Percussion: -ve
- iii) Radiograph: -ve
- iv) Vitality test: +ve thermal test specially with cold stimulus, responds at minimum current with EPT.

❖ *Treatment:*

- i) prevention is the best treatment.
- ii) removal of the cause.

B) Acute pulpitis (irreversible or symptomatic pulpitis):

- Clinically detectable inflammatory response of the pulp to irritants. Irritants may be primary (external as: heat, cold, sweet & sour) or secondary (internal as: dead cells, pus or protein breakdown products).
- *Characteristics of pain:*
  - i) severe, non bearable, throbbing pain.
  - ii) continuous (secondary irritants) or intermittent (primary irritants).
  - iii) diffuse or referred.
  - iv) increases during lying down due to increase in cephalic blood pressure.

- v) lingering or doesn’t disappear after removal of external irritant due to the presence of internal irritants that increases the intrapulpal pressure.
- vi) at early stage, both heat & cold cause pain.
- vii) at late stage, pain is caused by heat and relieved by cold (**HOT TOOTH**).

❖ *Clinical picture:*

- i) any cause of pulpal irritation.
- ii) percussion: -ve.
- iii) radiograph: -ve or slight widening with lamina dura.
- iv) Vitality tests: same as pulp hyperemia but pain persists after removal of stimulus.

❖ *Treatment:*

- Root canal treatment.

C) Subacute pulpitis:

- Clinical condition between acute and chronic.
- *Characteristics of pain:*
  - i) mild to moderate pain.
  - ii) may become acute or chronic at any time.

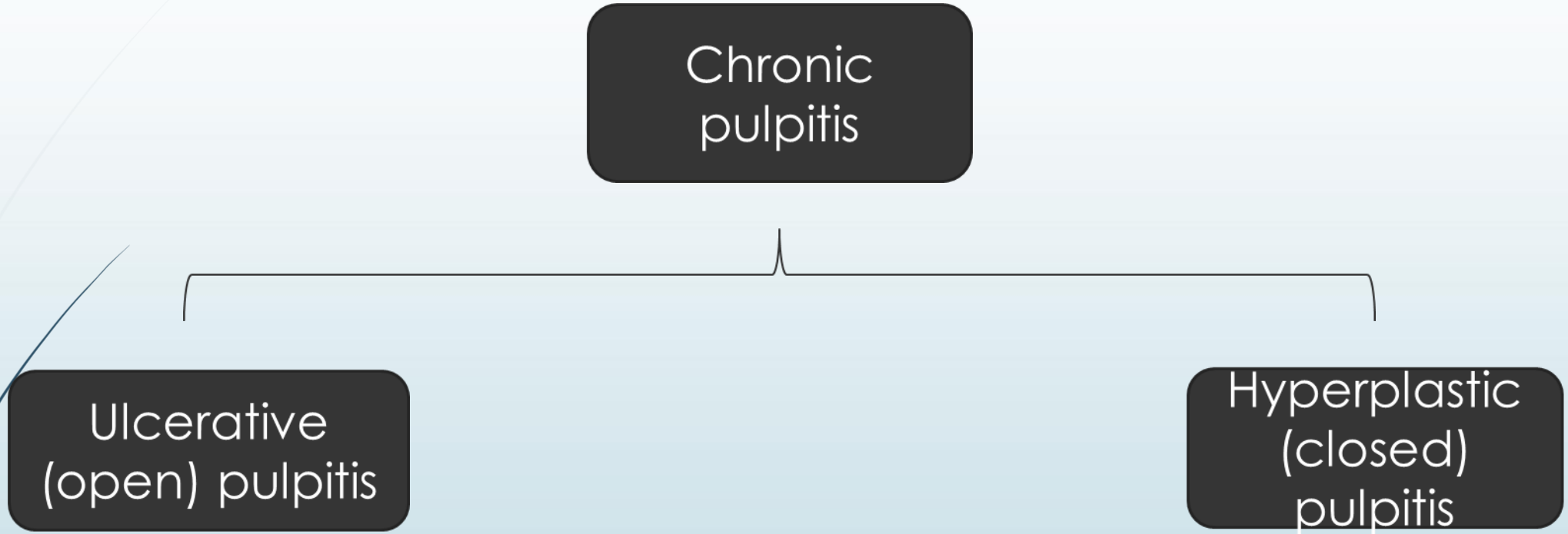
- *Treatment:*
  - Root canal treatment.

D) Chronic (asymptomatic) pulpitis:

- Inflammatory response of the pulp to an irritant where the proliferative forces are hyperactive.
- Inflammatory exudates is minimal → subthreshold intrapulpal pressure but with no pain as the exudates drain through carious cavity, venous or lymphatic circulation.

Drainage → balance between internal & external pressure → tissue proliferation (incomplete repair due to presence of toxins).

❖*Classification:*



D.1) Chronic ulcerative (open) pulpitis:

- Carious pulp exposure with formation of an abscess and surface ulceration at the point of exposure.

- *Characteristics of pain:*
  - i) no pain
  - ii) pain occurs only if drainage pathway is blocked changing to subacute or acute stage.

❖ *Clinical picture:*

- i) open carious cavity.
- ii) Radiograph: slight widening of lamina dura or -ve .
- iii) Vitality tests: -ve or slight response to high current.

❖ *Treatment:*

- Root canal treatment.

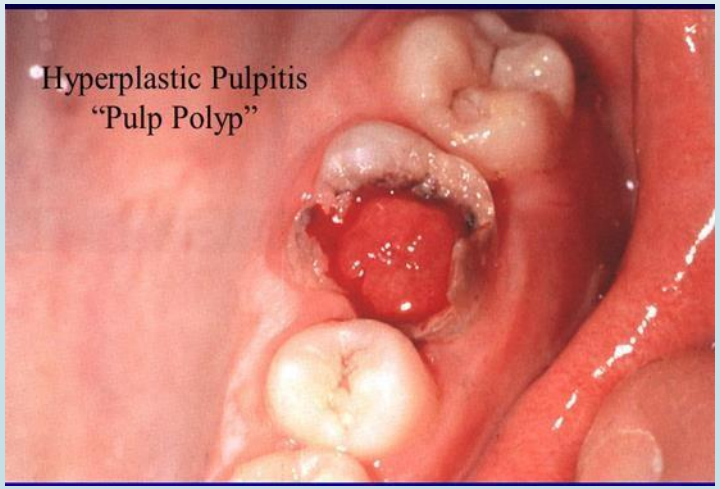
D.2) Chronic hyperplastic pulpitis (pulp polyp):

- Overgrowth (hyperplasia) of granulomatous tissue - into an open carious cavity- lined by stratified squamous epithelium from the oral mucosa.

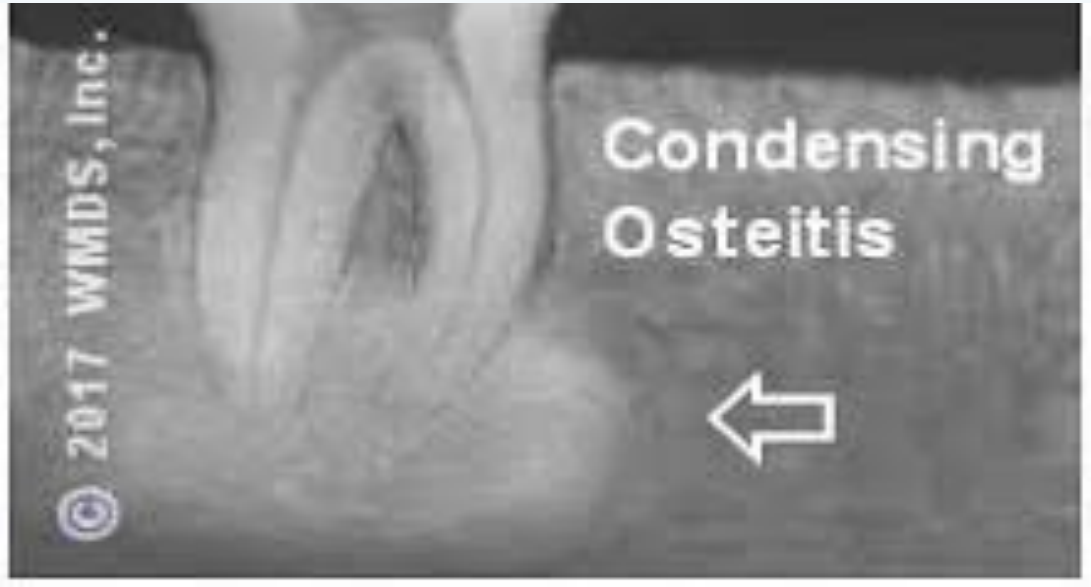
- *Characteristics of pain:*
  - pain is absent unless the polyp was probed.

❖ *Clinical picture:*

- i) wide carious cavity –frequently in proximal surfaces- with the polyp protruding from the pulp chamber.
- ii) in children and adolescents.
- iii) polyp appears as pinkish red globule that bleeds when probing.



- iv) Percussion: -ve.
- v) Radiograph: -ve, sometimes dense bone formation around the root apices of mandibular molars.



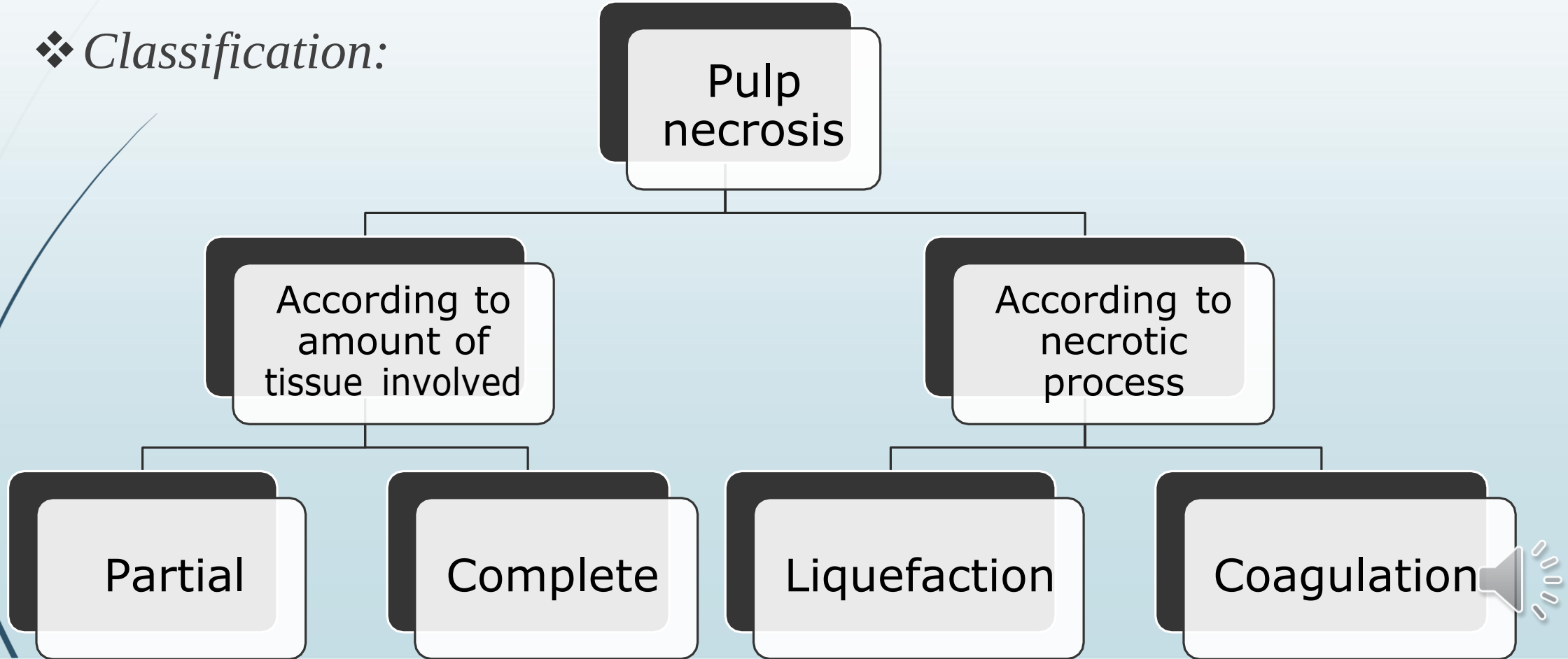
❖ *Treatment:*

- Root canal treatment after removal of the pulp polyp by sharp curette or cautery.

II] Additional pulp diseases:

A) Pulp necrosis:

- Death of the pulp tissue as a result of acute or chronic inflammation or due to an immediate arrest of blood supply to the pulp.
- *Classification:*



❖ *Characteristics of pain:*

- Painless in case of total necrosis.

❖ *Clinical picture:*

- i) old carious cavity or history of trauma.
- ii) discoloration of the involved tooth.
- iii) Percussion: -ve.
- iv) Radiograph: -ve or slight widening of lamina dura.
- v) Vitality tests: -ve. False +ve response could be seen in cases of multirooted teeth with partial necrosis or sometimes with liquefaction necrosis.

❖ *Treatment:*

- i) Root canal treatment.
- ii) Partial removal of necrotic tissues in the first visit & the remaining part removed in the second visit.
- iii) Complete debridement of the pulp space in the first visit & completion of the endodontic procedures in the second visit.

B) Retrogressive pulp changes:

- Degenerative, aging, dystrophic, catabolic or pulposis all have the same meaning.
- *Causes:*
  - attrition, abrasion, trauma, caries, pulp aging, reversible pulpitis and operative procedures.
- *Classification:*
  - i) Atrophy (fibrosis).
  - ii) Calcification.

B.1) Atrophy (Fibrosis):

- Decrease in size of an organ usually in attribution to faulty nutrition. Gradual shift in the ratio and quality of tissue elements occurs where there is increase in mature collagen fibres per unit area and decrease in size & number of pulp cells.
- *Characteristics of pain:*
  - painless

❖ *Clinical picture:*

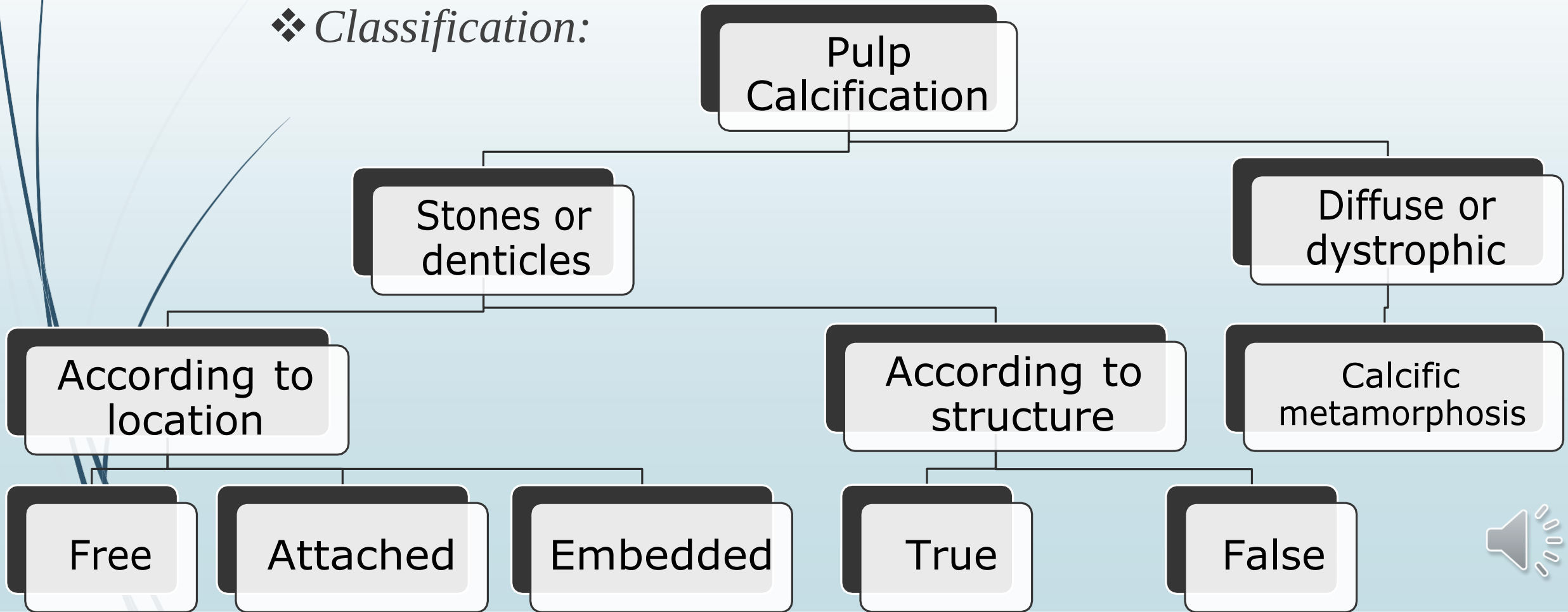
- i) presence of one or more of pulp irritants.
- ii) Percussion: -ve.
- iii) Radiograph: normal.
- iv) Vitality tests: tooth responds at high electric current.

❖ *Treatment:*

- No treatment
- Removal of the cause.

B.2) Calcification:

- May begin in the connective tissue walls of blood vessels and nerves then deposits fuse to become long, thin and fibrillary.
- *Classification:*

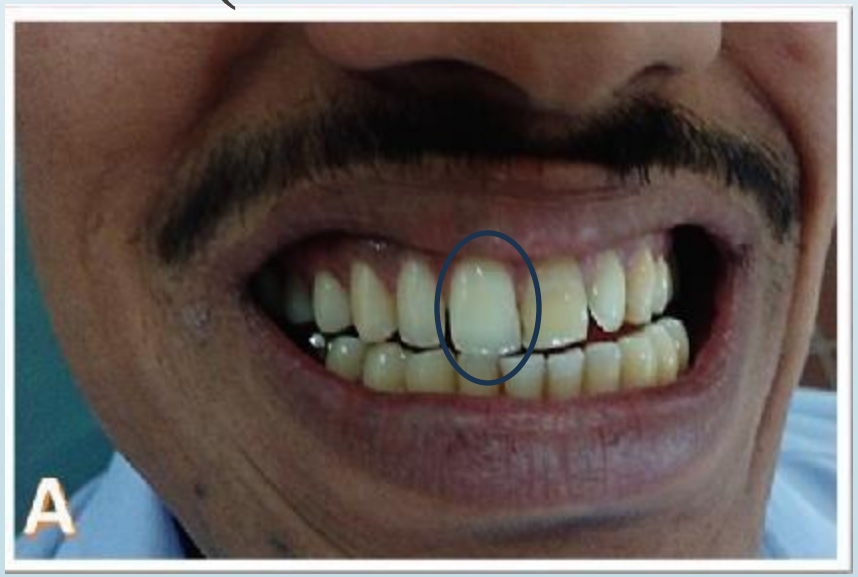


❖ *Characteristics of pain:*

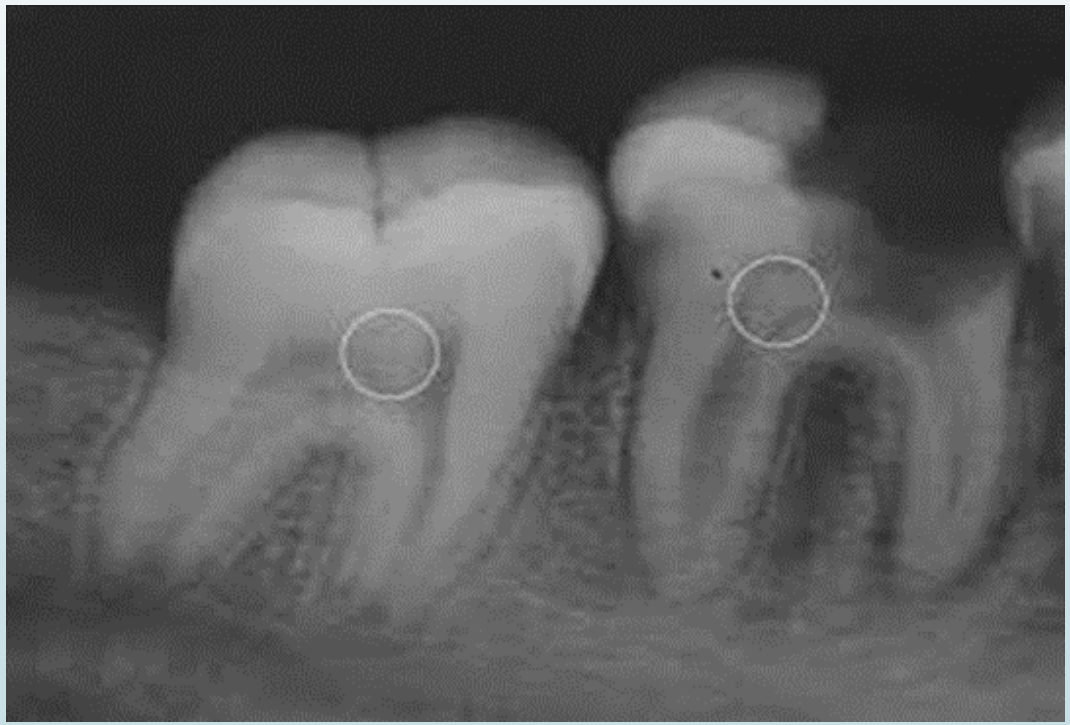
- i) painless
- ii) sometimes pain may arise from the pulpal condition that caused calcification.

❖ *Clinical picture:*

- i) history of one of the irritating or stimulating factors.
- ii) Visually: tooth appears dull, lifeless like a piece of chalk (**CHALKY TOOTH**).



- iii) Percussion: -ve.
- iv) Radiograph: Calcific deposits are present.



- v) Vitality tests: normal response unless calcification is completed.

❖ *Treatment:*

- i) No need to interfere.
- ii) If there is any need for RCT, chelating agents are needed during preparation.

C) Internal resorption:

- Sometimes termed idiopathic resorption.
- *Causes:*
  - i) trauma.
  - ii) persistent chronic pulpitis.
  - iii) idiopathic.

❖ *Characteristics of pain:*

- No pain

❖ *Clinical picture:*

- i) history of one of the mentioned causes.
- ii) Visually: tooth may show one or more pink spots.

❖ *Treatment:*

- i) RCT as soon as possible.
- ii) to wait and see means more loss of tooth structure.

Periapical Diseases of Pulpal Origin:

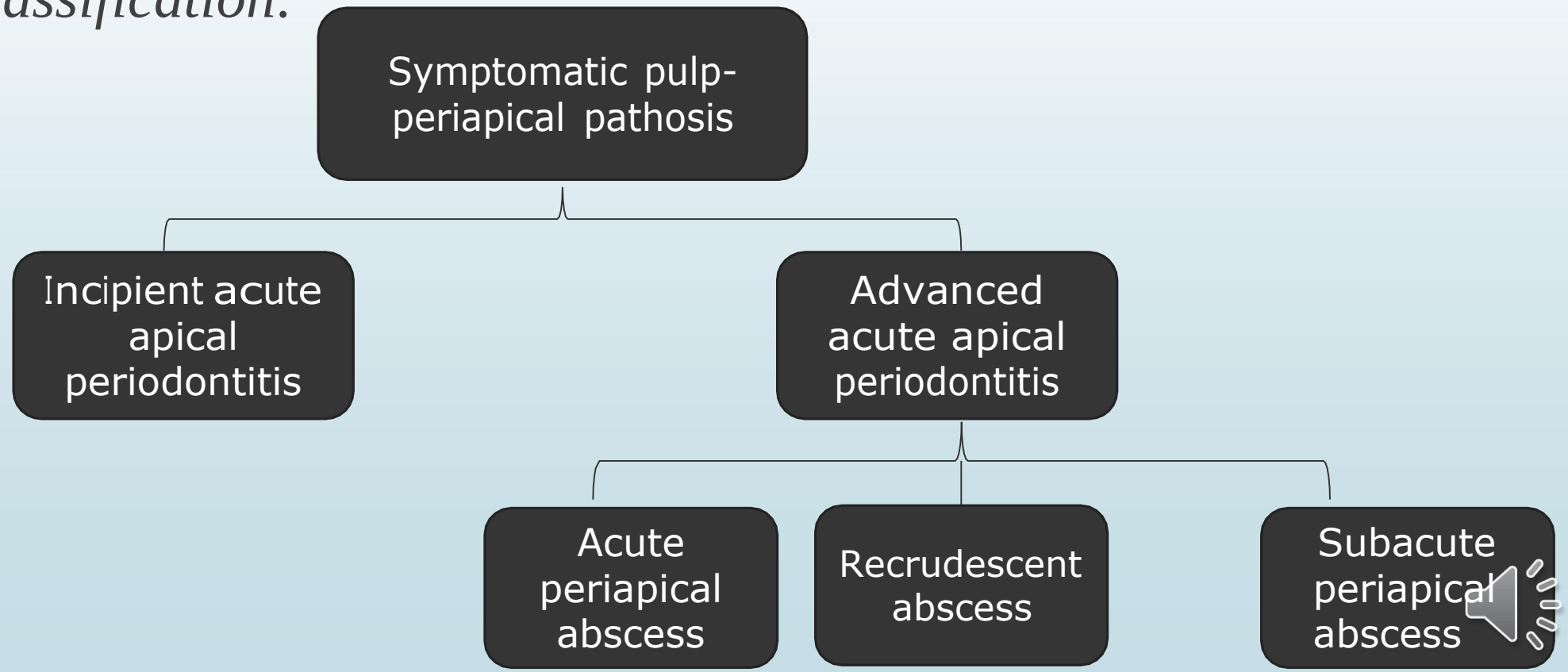
(Pulpo-Periapical pathosis)

Etiology:

- Pulp extirpation creates a wound at the pulp-periapical junction.
- Over extended instrumentation.
- Forcing debris, irrigating solution, micro - organisms…etc, into the periapical area.
- Incomplete removal of inflamed vital pulp tissues.

I] Symptomatic pulp-periapical pathosis:

- Inflammatory response of the peri-apical connective tissue to pulpal irritants.
- *Classification:*



A) Acute apical periodontitis:

- Irritation → inflammation → local vasodilatation → stagnation of blood → release of exudates → elevate intra-periodontal pressure → tooth feels elongated.*
- Constant increase in pressure → activation of osteoclastic formation → bone resorption.
- *Characteristics of pain:*

  i) pain intensity increases & tooth become tender to percussion & even touch.

  ii) pus formed seeks a pathway of least resistance through alveolar bone causing additional feeling of elongation & fullness.

- iii) pus drains through the submucosal or surgical spaces cellulitis.
- iv) as pus penetrates outer cortical plate, pain is lowered & swelling appears.
- v) pain & tenderness range from mild to moderate to intense, continuous throbbing.
- vi) pain is localized.

❖ *Clinical picture:*

- i) history of carious exposure or one of the irritants mentioned earlier.
- ii) in the early stage, swelling is absent but firm pressure opposite to the root incites pain.
- iii) swelling appears in advanced stage with fluctuating mucosa.
- iv) pus & infection may spread to fascial spaces.
- v) patient is febrile.
- vi) Percussion & palpation: tenderness to percussion & feeling of swelling.

- vii) Radiograph: slight widening inlamina dura.
- viii) Vitality tests: depends on the condition of the pulp;
  - a) vital inflamed: +ve response.
  - b) necrotic: -ve response.

❖ *Treatment:*

- i) RCT
- ii) in case of acute periapical abscess, drainage should be done through the canal.
- iii) Incision & drainage is done if drainage is not possible through the canal.

B) Recrudescent abscess:

- Acute exacerbation of a chronic periapical lesion. Sometimes called phoenix abscess.

❖ *Characteristics of pain:*

- similar to acute periapical abscess.

❖ *Clinical picture:*

- i) presence of old deep cavity with history of chronic periapical lesion.
- ii) Percussion & palpation: severe pain to percussion.
- iii) fluctuating swelling may be present.

- iv) tooth mobility.
- v) Radiograph: well defined radiolucency.
- vi) Vitality tests: -ve.

❖ *Treatment:*

- RCT following:
- i) drainage through the canal.
- ii) incision & drainage if pus doesn’t drain through the canal.

C) Subacute periapical abscess:

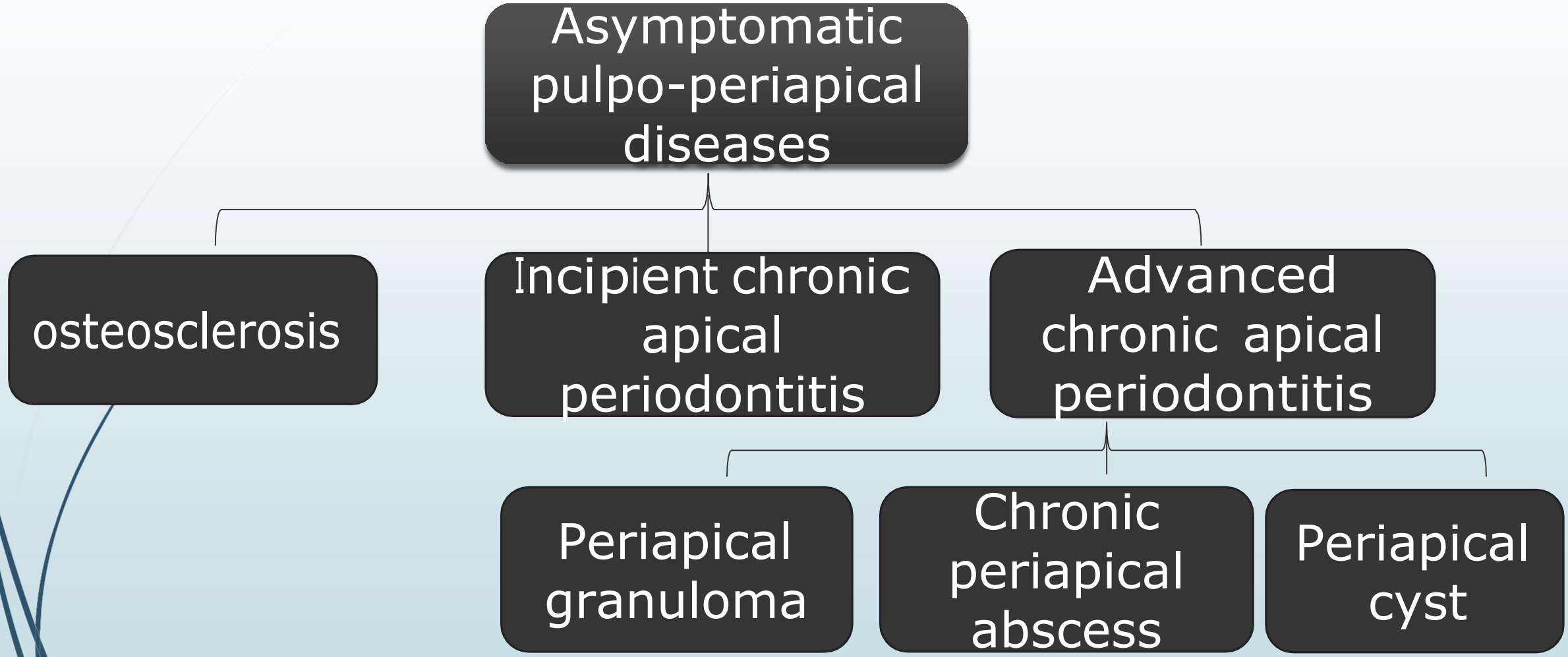
- Condition having signs & symptoms between acute & chronic.

- If a sinus tract or drainage cavity was blocked or new virulent micro-organisms were pushed inside, acute exacerbation occurs.

II] Asymptomatic pulpo-periapical pathosis:

- Inflammatory response of periapical connective tissue to pulp irritants, where proliferation forces are hyperactive.
- *Causes:*
  - i) chronic condition may develop from acute condition in which irritants were downgraded or body resistance is improved.
  - ii) may develop as chronic from the onset.

❖ *Classification:*



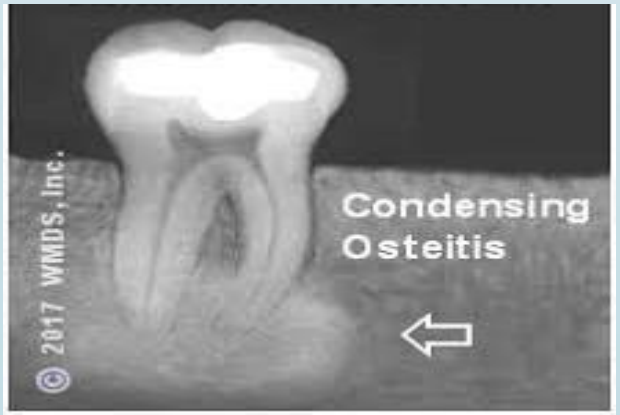
A) Pulpo-periapical osteosclerosis:

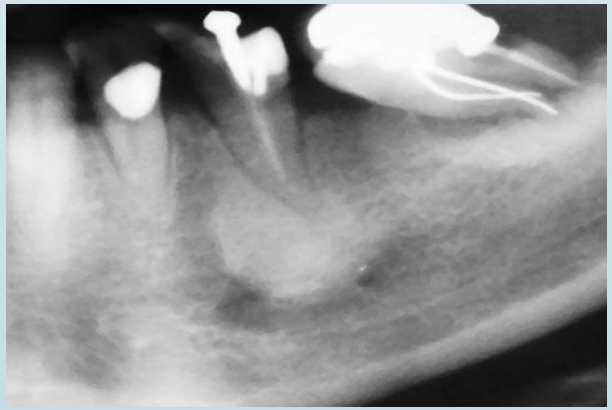
❖ *Causes:*

- Low grade, longstanding pulpal irritation.

❖ *Clinical picture:*

- i) mandibular molars of young patients.
- ii) Radiograph: increase the density of bone in the periapical area due to osteoblastic hyperactivity.





❖ *Treatment:*

- RCT returns the area into normal trabecular bone.

B) Incipient chronic apical periodontitis:

- *Histological picture:*
  - i) Slight vasodilatation.
  - ii) mild exudates.
  - iii) accumulation of chronic inflammatory cells.
- A state of balance between irritants and resistance.

C) Advanced chronic apical periodontitis:

- Continuous drainage of exudates ⟶ decreases intra-periapical pressure ⟶ granulation tissue proliferation.

C1) Periapical granuloma:

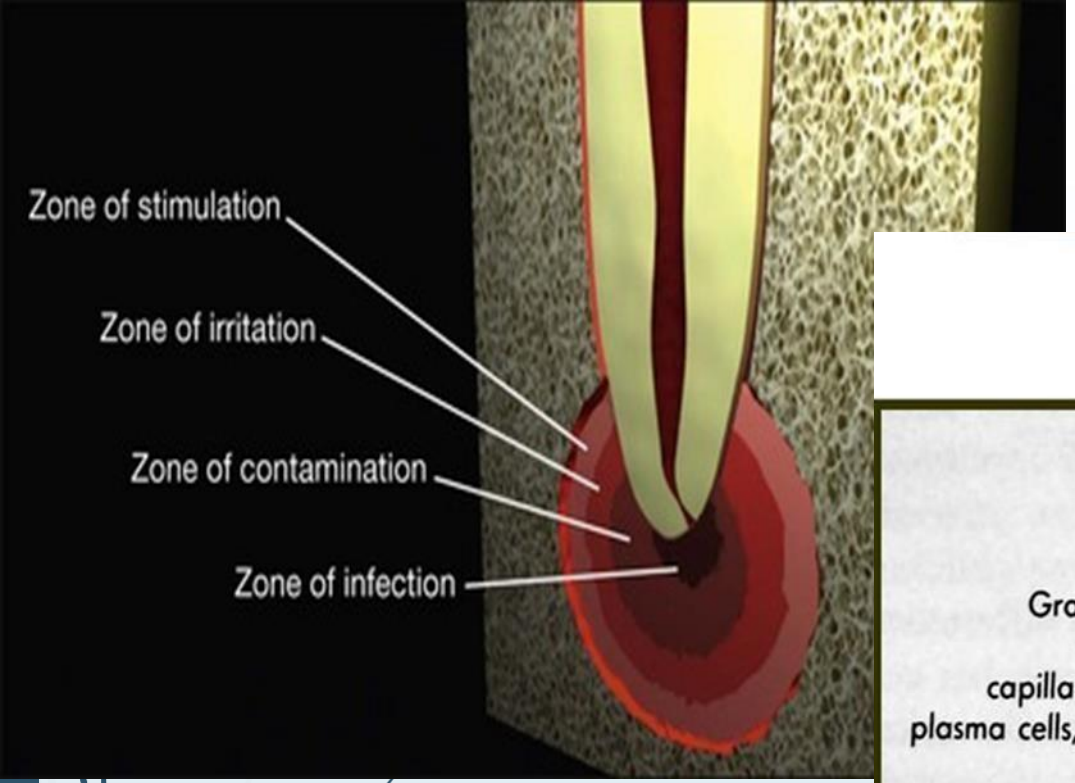
- *Causes:*
  - i) chronic apical periodontitis.
  - ii) continued pulpal irritation.

❖ *Zones of granuloma (Sequence of events):*

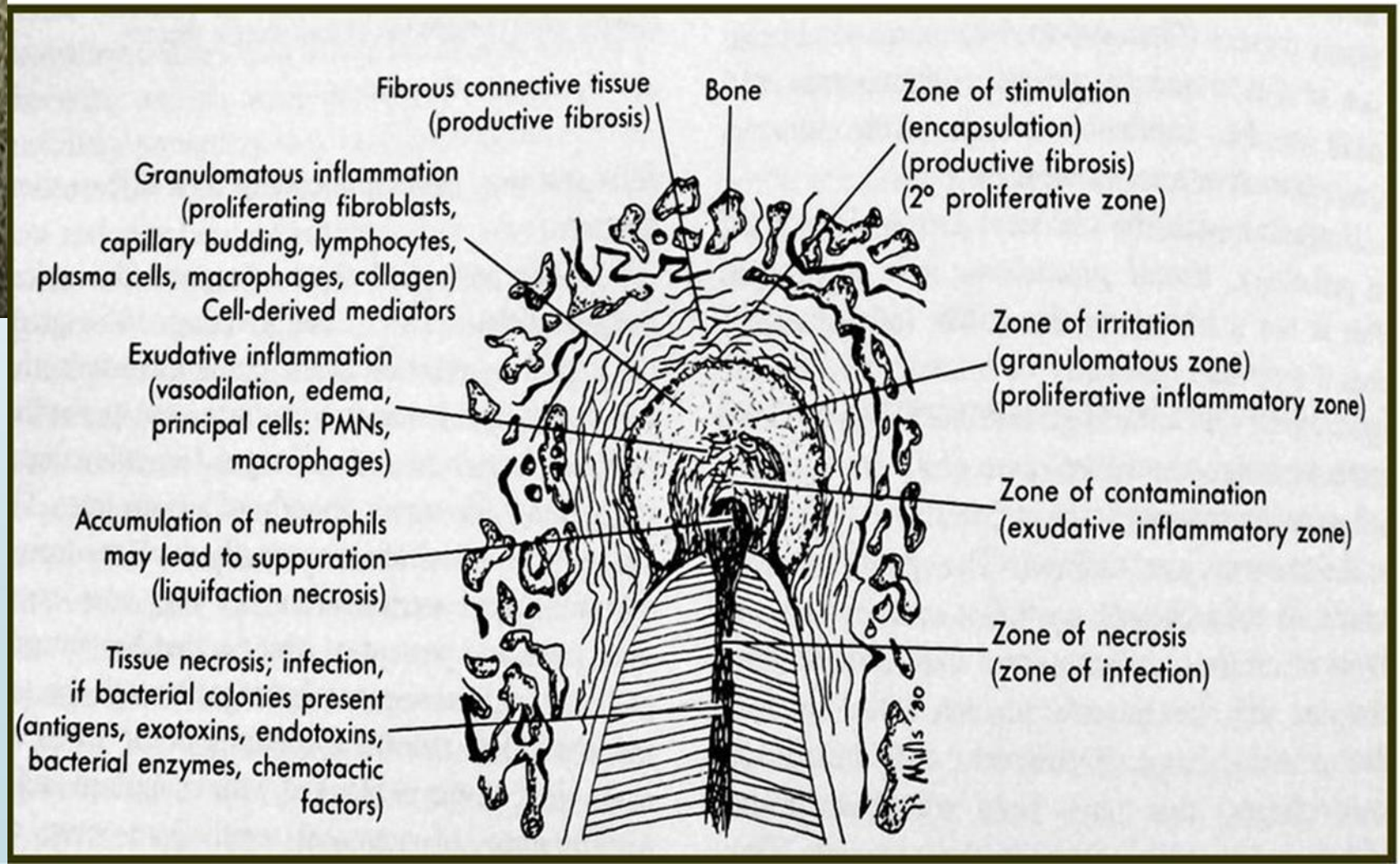
- i) Zone I: zone of necrosis.
- ii) Zone II: zone of contamination.
- iii) Zone III: zone of irritation.
- iv) Zone IV: zone of stimulation.

❖ *Characteristics of pain:*

- painless


Zone of stimulation
Zone of irritation
Zone of contamination
Zone of infection

(FISH'S ZONES)


Fibrous connective tissue (productive fibrosis)
Bone
Zone of stimulation (encapsulation) (productive fibrosis) (2° proliferative zone)
Granulomatous inflammation (proliferating fibroblasts, capillary budding, lymphocytes, plasma cells, macrophages, collagen) Cell-derived mediators
Zone of irritation (granulomatous zone) (proliferative inflammatory zone)
Exudative inflammation (vasodilation, edema, principal cells: PMNs, macrophages)
Zone of contamination (exudative inflammatory zone)
Accumulation of neutrophils may lead to suppuration (liquifaction necrosis)
Zone of necrosis (zone of infection)
Tissue necrosis; infection, if bacterial colonies present (antigens, exotoxins, endotoxins, bacterial enzymes, chemotactic factors)
Mills '80

❖ *Clinical picture:*

- i) old carious cavity.
- ii) discoloration of the tooth.
- iii) Percussion & palpation: -ve.
- iv) Mobility: some mobility may be present (grade I).
- v) Radiograph: widening of the lamina dura or radiolucent area.
- vi) Vitality tests: -ve.

❖ *Treatment:*

- i) RCT.
- ii) Surgical intervention if the radiolucent area doesn’t resolve.

C2) Chronic periapical abscess:

- Similar to the previous cases but sometimes it may open with a sinus tract and slight swelling (gumboil) around the stoma of the sinus.

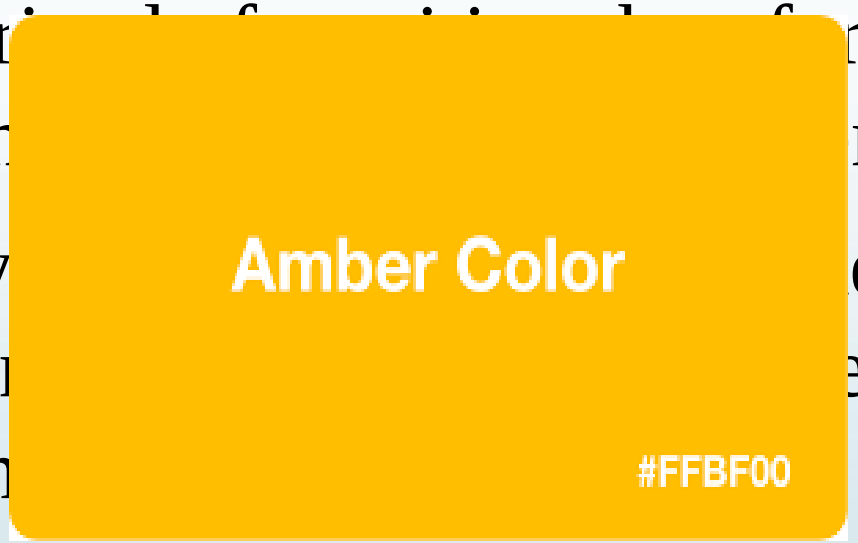
C3) Periapical cyst:

- A periapical granuloma with central fluid filled, epithelial lined cavity.

- *Sequence of events:*

- Epithelial cells undergo mitosis & proliferation in all directions simultaneously forming a ball of epithelial cells.
- As the epithelium increases in size → finger like projections of the surrounding granulation tissue extends deep into the epithelium to supply nutrients & oxygen.

- With increasing the epithelial size, the central cells become depri re degenerate & die formin ma).
- Central cavity elial cells and containi ent stages of degeneration
- Fluid in the cystic cavity varies from clear amber* to viscous yellow. Cholesterol crystals (product of cellular fatty degeneration) are deposited in the walls of the cystic cavity.



❖ *Characteristics of pain:*

- i) no pain.
- ii) patient may feel discomfort.

❖ *Clinical picture:*

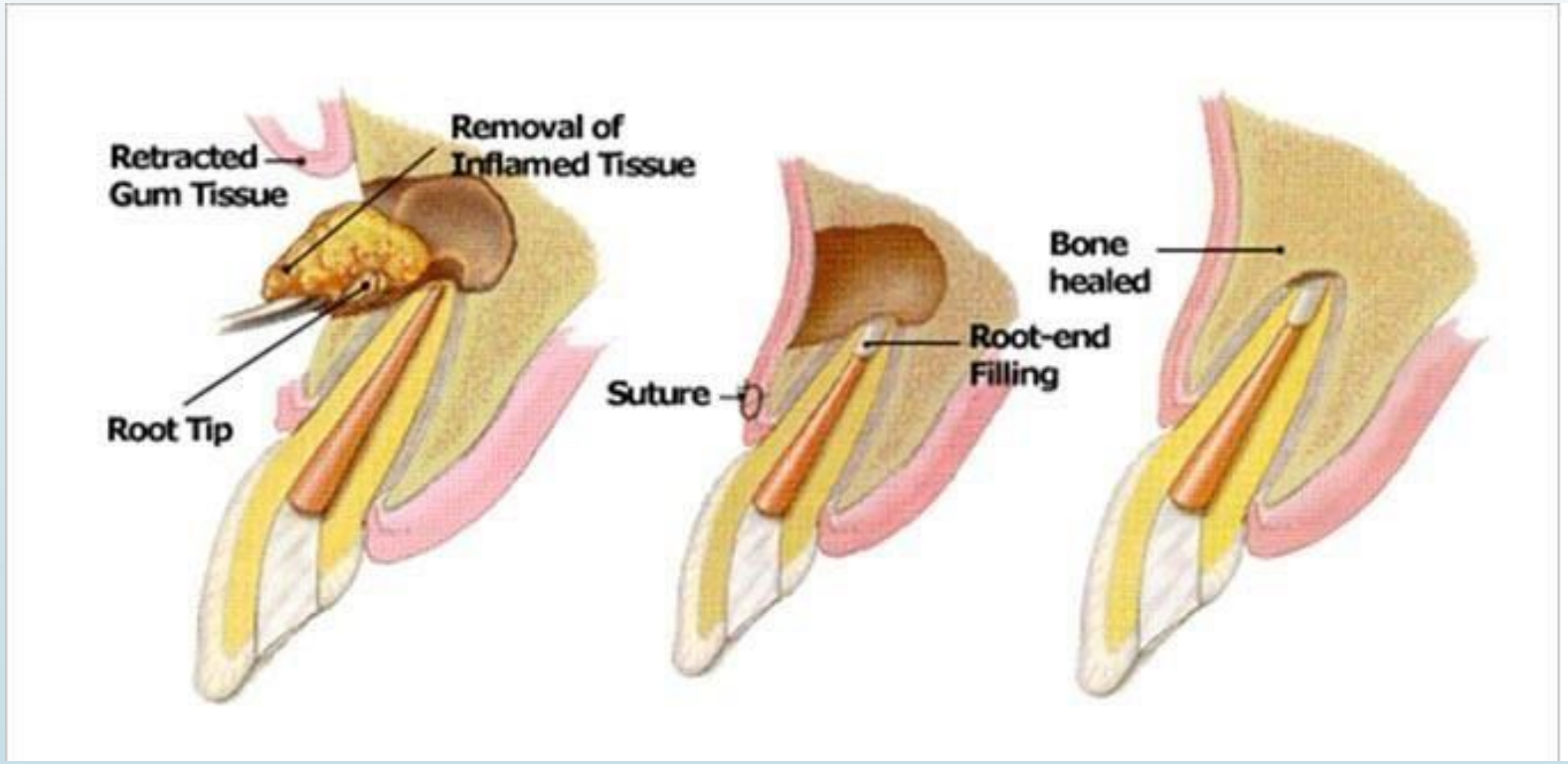
- i) Percussion & palpation: tenderness to percussion.
- ii) swelling may be noticed particularly when drainage pathway is blocked.

- iii) Mobility: when there is excessive bone resorption.
- iv) Radiograph: well defined radiolucency surrounded by radio-opaque hyperostotic border.

- v) Vitality tests: -ve.

❖ *Treatment:*

- RCT, surgical enucleation of the cyst with apicectomy and retrograde filling.



Have a Wonderful Day!

This is not a

GOODBYE

BUT A

'see you soon'.